Exit in Extremis . . . . .

fact, nothing of the kind occurs. Black-out is caused by imparting an acceleration to the blood, tending to cause it to drain from the eyes and brain and, if the acceleration is maintained for a sufficiently long time, temporary loss of sight will occur, followed in extreme cases by unconsciousness. The criterion of this effect is, of course, time. In common with all matter, blood has inertia, and if a force is applied sufficiently long for inertia to be overcome, then the blood will start to move. Thus it is that, if a (relatively) mild acceleration of, say, 5 g, is imposed for longer than about five seconds, black-out will be experienced. It is just this quality of inertia that prevents black-out occurring in the ejected pilot, for although the force applied is over 18 g, the period of application is only ½ of a second, and in so short a period its inertia prevents the blood moving unduly—that is, of course, aside from its normal function of circulation.

Series Firing

This smooth progressive acceleration is achieved by firing two cartridges in series. When the main cartridge is fired, it produces a progressive acceleration reaching a maximum of about 15 g in a period of a little under 0.1 seconds. During this time, the seat is moved 10 in on its run, at which point the blast of the main cartridge breaks a diaphragm and ignites the auxiliary cartridge. This increases the acceleration slightly to 18.75 g, and sustains it until a period of about 0.14 seconds has elapsed from the initial ejection action.

A measure of the progressiveness of acceleration is given by movement against time. The first 10 in of movement takes roughly $\frac{1}{10}$th of a second, but during the second $\frac{1}{10}$th of a second, i.e., making the total period $\frac{1}{5}$th sec, the seat moves a further 32 in (the total gun stroke being 42 in) and at the time the seat leaves the gun it is travelling at a speed of 60 ft/sec, that is, just over 40 m.p.h. The only reason for using two cartridges in series is to obtain a progressive push. The same thing could be achieved with a single cartridge if the rate of burning were sufficiently slow; this, however, has proved to be difficult to arrange with any degree of reliability, and the two-cartridge system is by far the more practical, especially as there are no inherent drawbacks.

This twin-cartridge scheme has been tested on the ejection seat test tower with a load in the seat equalling 5½ g. These conditions were obtained by means of long elastic cords running over pulleys at the base of the tower and tensioned by chain blocks until the load equalled 1,100 lb, that is, 5½ times 200 lb. Under such a test, the pressure curve showed only very slight variation from the curve obtained with the 1 g condition. This test is important in showing that a successful ejection could be made without difficulty with a pre-load acceleration of 5½ g imposed on the aircraft, such as might apply if the machine suddenly changed direction during the period of ejection.

Seat chassis, guide-rail and gun, all form a self-contained assembly which can simply and easily be installed in the aircraft. One of the features which all Martin-Baker products have in common is design for maintenance expediency, and the ejection seat has this quality in good measure.

The guide-rail is a box-form structure, down the centre of which is housed the gun. The rail can be attached to the aircraft either by holding-down bolts at the feet, or by lateral bolts picking up to the webs. The upper attachment can be of the most suitable kind, for the particular aircraft installation, which will look after the crash-condition stress requirement of 25 g. The heel of the gun registers with a base block in the foot of the guide-rail, being locked there by a simple spring-loaded latch, whilst the top of the gun registers in a cross-head spanning the top of the seat frame, the anchorage in this case also being by means of a simple latch mechanism. A quadrantal frame is fitted around the gun cylinder about 3 in below the head to ensure concentric location in the guide-rail box structure. Thus the guide-rail is anchored to the aircraft, the gun is anchored to the guide-rail and the seat is anchored to the gun. When speaking of the gun, it will be convenient to refer to the "bullet" as being part of the gun, for it is to the "bullet" that the seat is attached.

A simple cylindrical barrel forms the gun and houses a tubular "bullet." At the base of the barrel is threaded a heel block comprising a spring-loaded piston axially contained within a twelve-segment chuck. The upper ends of the chuck segments are under-cut on the outer diameter to engage a shoulder in the mouth of the "bullet" tube. This effectively locks the "bullet" to the gun which, as already mentioned, locks the seat to the aircraft. When the main cartridge is fired, gas pressure forces the piston in the heel block down against a spring, so allowing the chuck segments to close radially inward and thus free the "bullet" to move from the gun.

(Centre) Having drawn back his feet into the foot rests, the pilot pulls down the blind over his face and so fires the gun to eject himself, complete with seat, clear of the aircraft.

(Right) Chassis with seat pan removed to show frame structure. Note the guide rollers at the base of the frame members.

(Below) The seat pan is a very light but immensely strong fabrication of light alloy sheeting.